VARIATIONS IN GONADOTROPIC AND THYROTROPIC POTENCY OF PITUITARIES FROM PREGNANT AND NON-PREGNANT SWINE

BY

GEORGE EDWARD ROBINSON, JR.

B.S., Alcorn A. & M. College, 1942
M.S., University of Illinois, 1945

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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IN THE GRADUATE COLLEGE OF THE
UNIVERSITY OF ILLINOIS, 1950

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VARIATIONS IN GONADOTROPIC AND THYROTROPIC POTENCY OF PITUITARIES FROM PREGNANT AND NON-PREGNANT SWINE

Nearly a quarter of a century ago Smith (1926-27) and Zondek and Aschheim (1927) published their widely quoted papers giving the first experimental demonstration that precocious sexual maturity could be produced in immature mice and rats by the implantation of pituitary glands. Following these demonstrations, a vast amount of work on the gonadotropic content of the anterior pituitary has been reported. Assays have been made of pituitary glands from many species of laboratory and farm animals as well as from the human to ascertain the influence of age, sex, pregnancy, castration, sex cycle, etc. on the hormone content of pituitaries.

Previous assays studies of the pituitary failed to give due consideration to (1) the potency of individual glands which would enable one to compare glands from individuals showing normal and abnormal functions; (2) the amount of pituitary tissue used; and (3) suitable test animals which would give the most accurate quantitative results. Thus, it seemed worthwhile to undertake a series of assays of pituitaries from a large number of donors of the same species using methods and techniques which would rectify the foregoing shortcomings. Such a study, it seemed, might throw further light on the role of the pituitary in sexual development and function, and the reciprocal relation between gonads and pituitary.

A lack of systematic study of the gonadotropic complex, and conflicting statements concerning the thyrotropic hormone content of swine pituitaries have lead us to investigate the potency of these hormones in individual pituitaries of swine.

The injection of an aqueous suspension of 10 mgs. of dried pituitary powder into day-old male chicks was found to increase the size of the gonads and thyroids sufficiently to

permit the quantitative assay of individual pituitaries of swine. Included in this study were the pituitaries of 95 non-pregnant and 104 pregnant swine. These glands were assayed to determine the changes occurring in their gonadotropic and thyrotropic hormone content: (a) during the estural cycle, (b) during pregnancy, (c) as a result of line or strain differences, and (d) as a result of certain types of reproductive abnormalities.

In normally cycling animals, a gradual but significant increase in gonadotropic and thyrotropic potency takes place from ovulation until the following heat. The number of follicles (follicle index) also increases during the same period. A very high positive correlation ($r = +.67$) exists between the follicle index and the day of the cycle ($P \leq 0.01$). Similar correlations exist between day of cycle and gonadotropic potency ($r = +.62$) and between the follicle index and gonadotropic potency ($r = +.68$). Both of these correlations are highly significant beyond the 1 per cent level. If our population is typical, these high correlations indicate that as far as gonadotropic hormone is concerned the potency of the pituitary accurately reflects the rate of secretion of that hormone by the pituitary. The correlation between day of cycle and thyrotropic potency ($r = +.42$) is significant at the 5 per cent level.

There is a decrease in the gonadotropic potency of swine pituitaries from early pregnancy until parturition. The gradual decrease in potency of the pituitary may be explained on the theory that estrogen secreted by the placenta in increasing amounts toward the end of pregnancy has an inhibiting effect on the rate of gonadotropic hormone secretion by the pituitary. A series of correlations and multiple regression were calculated in order to establish the cause and effect relationship existing between the various factors which were thought to be influenced by these hormones. It was found that, of all the known factors which may have an effect on the gonadotropic potency of the pituitary, the stage in pregnancy (fetus length) is most important ($b = .2655$).

However, "other factors" ($O = .9544$) apparently play an even greater role. The average correlation between stage in pregnancy and gonadotropic potency ($r = -.25$) is statistically significant at the 5 per cent level and shows that with advancing gestation the gonadotropic hormone content of the pituitary decreases significantly. Correlations between litter size and pituitary potency, litter size and stage in pregnancy (fetus length) and between pituitary weight and pituitary potency all failed to show statistical significance. The average correlation between stage in pregnancy and pituitary weight ($r = +.41$) and litter size and pituitary weight ($r = +.29$) was also found to be highly significant ($p \leqq 0.01$). Pituitaries from swine carrying predominantly female litters appeared, on the average, to be richer in the gonadotropic hormone than those from swine carrying predominantly male litters. This difference was not significant. The thyrotropic hormone potency of pregnant swine remains approximately the same throughout the course of gestation. It should be noted, however, that the thyrotropic potency of the pituitaries of pregnant swine is significantly higher than that of non-pregnant animals.

A highly significant statistical difference exists between the rapid and slow growing swine with regards to the amount of gonadotropic hormone secreted by the pituitaries ($p \leqq 0.01$). The line which was genetically selected to gain in weight more rapidly than the other line was less potent in this hormone. This difference is presumably due to the different genotypes of the two lines and is inherited. The thyrotropic hormone content of pituitaries from the two lines was approximately the same.

The gonadotropic hormone content of the galnds from cystic swine, both pregnant and non-pregnant, did not differ significantly from the non-cystic groups in comparable stages of gestation and the estrual cycle respectively. In contrast, the thyrotropic hormone content of glands from non-pregnant cystic swine was consistently higher than that of normal swine ($p \leqq 0.05$). As expected, there was no significant

difference between the activity of glands from non-cystic "sterile" females and that of normal controls.

The 628 injected chicks showed a highly significant increase in testes weight and thyroid weights ($p \leq 0.01$) over those of the 132 uninjected controls regardless of the original source of the pituitary powder used.

Conclusions

The results obtained in these experiments permit the following conclusions:

1. The increase in gonadotropic and thyrotropic potency of the pituitary and the concurrent increase in the number of follicles during the estrual cycle of the sow, conclusively show that the assay of the pituitary for gonadotropic hormones accurately reflects the rate of the secretion of this hormone. The results obtained in the present sudy should settle this important and much debated point.

2. There is a significant decrease in the gonadotropic potency of swine pituitaries from early pregnancy until parturition. The thyrotropic hormone potency of pregnant swine remains approximately the same throughout the course of gestation, but is significantly higher than the thyrotropic potency of pituitaries from non-pregnant females.

3. The gonadotropic hormone content of pituitaries from the slow growing line was significantly higher than that of the females from the rapid growing line. The thyrotropic hormone content of pituitaries from the two lines was approximately the same.

4. Ovarian cysts do not produce a significant change in the gonadotropic hormone content of swine pituitaries, but the thyrotropic hormone content of glands from non-pregnant cystic swine is consistently higher than from those of normal swine.

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VITA

George Edward Robinson, Jr. was born on a farm near Cary, Mississippi May 4, 1916. He attended grade school in Yazoo and Humphreys Counties, Mississippi and high school at the Humphreys County Training School, Louise, Mississippi from 1934 to 1937, and was graduated from Magnolia Avenue High School, Vicksburg, Mississippi in 1938.

In October, 1938 he entered Alcorn A. & M. College, graduating with the degree of Bachelor of Science in Agricultural Education in May, 1942.

From June, 1942, to February, 1944, he was employed by the Wetstone Tobacco Corporation of Hartford, Connecticut, and the Gulfport Army Air Base, Gulfport, Mississippi.

He enrolled in the College of Agriculture of the University of Illinois in February, 1944, and in the Graduate School of the same institution in October, 1944, and received the Master of Science degree in June, 1945.

From June, 1945 to August, 1945, he was employed as a visiting instructor in Agriculture at Lincoln University, Jefferson City, Missouri. From August, 1945 to July, 1947, he was an instructor in Animal Husbandry at Alcorn A. & M. College, Alcorn, Mississippi.

He re-entered the University of Illinois Graduate School in October, 1947 to work toward the degree of Doctor of Philosophy. His graduate work consisted of a major in Animal Science, first minor in Agronomy, and second minor in Animal Nutrition.

He is a member of Sigma Xi, Phi Sigma, American Society of Animal Production and is a 32nd Degree Mason.